

TOWARDS A BETTER UNDERSTANDING OF THE GEOLOGIC ANOMALIES AND MANTLE DYNAMICS: CLUES FROM PALEOMAGNETIC INVESTIGATIONS OF LARGE IGNEOUS PROVINCES

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ABSTRACT: The Cretaceous was a period of great unrest in geologic history. Rates of continental drift (i.e., also sea-floor spreading rate) were then about three times as great as they are now. Geological evidence also points towards an unusually high rate of volcanic activity in Cretaceous. Huge volumes of magmatic material flowed to Earth's surface from the mantle, and not just from the typical seafloor spreading process. The crustal-growth events termed "large igneous provinces" or LIPs made very important contributions to the lithosphere during the Cretaceous. This global magmatism is marked as well by increases in production of oceanic plateaus, seamount chains, and continental flood basalts. The volcanic carbon dioxide emissions released by the Cretaceous LIPs may have helped cause the unusual global warmth and triggered two to seven oceanic anoxic events (OAEs). The Cretaceous was also a time of rapid radiation and turnover in the marine plankton, benthic foraminifera, and terrestrial plants. This evolutionary activity transformed many of these groups on an ocean-wide basis. The reorganization of the global biosphere during the Cretaceous paralleled the marked changes in the ocean-climate system, suggesting a causal relationship between biotic evolution and environments. Other geologic anomalies associated with the Cretaceous thermal activity include the extremely high development of the Earth's diamond bearing kimberlites in mid-East and South Africa. Most diamonds in the world are old (more than a billion years ago), but many of them were brought to the surface during the Cretaceous. A key piece in this Cretaceous geologic puzzle is the Cretaceous Normal Superchron, a period in which Earth's magnetic field was so uncharacteristically steady that it did not switch from normal to reversed polarity for about 40 million years (Aptian to Santonian). These remarkable geological and geophysical signals in the Cretaceous have excited great interest in the geoscience community, leading many to suggest a connection between all of these phenomena and deep-mantle convection. Resolution of this problem would have great ramifications in Earth sciences. In the last two decades, many interdisciplinary investigations have been carried out to seek the possible connections between all these phenomena and deep-mantle convection and significant progress has been made toward understanding this list of Cretaceous geologic phenomena. In this talk, we will present results of our paleomagnetic investigations on several Cretaceous LIPs (the Ontong Java Plateau in the Pacific and the Kerguelen Plateau in the south Indian Ocean) and explore possible connections with these global geologic events of Cretaceous, and discusses directions of future research in this important area.

Keywords: LARGE IGNEOUS PROVINCES, CRETACEOUS, PALEOMAGNETISM